EX 3

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IN THE MATTER OF
International Patent Application
No. PCT/EP2003/013154
In the Name of Braun GmbH

DECLARATION

I, BIRGIT HUBATSCH, of Elisabethenstr. 33a, D-64390 Erzhausen, Federal Republic of Germany, do hereby declare as follows:

1. That I am well acquainted with both the English and German languages and am a competent translator thereof; and

2. That the attached English text is a true and correct translation made by me to the best of my knowledge and belief of the specification accompanying the International Patent Application No. PCT/EP2003/013154.

Signed this 17th day of May 2005

BIRGIT HUBATSCH ★ 64390 ERZHAUSEN ★
Allgemein beeidigte Übersetzerin der englischen Sprache für Gerichte und Notare im Lande Hessen Sworn Translator

Birgit Hubatsch
Sworn Translator

Electrical Appliance Housing

This invention relates to a housing, for example, an electrical appliance housing or other, as the case may be, watertight housing, with a housing body made from hard plastic, in which provision is made for an aperture to actuate a switch or the like in the interior of the housing body, said aperture being sealed by means of a membrane of soft plastic, and further provision is made for an actuating button on or in the membrane for actuating the switch.

Electric toothbrushes or other small electrical appliances such as shaving apparatus, kitchen machines and the like usually have a watertight housing in the interior of which there are often switches, thus requiring the actuating energy for such switches to be passed through the housing wall in a manner preventing the ingress of water. In a typical arrangement the switch in question or the brake or coupling or valve or transmission, etc. to be actuated lies behind an aperture in the housing wall which is sealed by an elastic membrane. To switch the appliance the user presses with a finger on the membrane, thereby actuating the switch underneath. The membrane is made of soft plastics material which is bonded to the hard plastics material of the housing wall, in particular injection-molded by the two-component injection method.

As a visual and tactile pointer to the underlying switch the membrane often has an elevation or some other three-dimensional structure on its outside. However, a disadvantage of this construction is that the three-dimensional structure is made of the same material as the membrane and thus has the same color. This impairs recognition.

For this reason, provision was already made on known appliances to insert a metal actuating button in a hole passing right through the membrane. However, such an arrangement has the disadvantage that water is allowed to pass through the hole into the interior of the housing. The watertightness of the housing is no longer assured.

It is therefore an object of the present invention to provide an improved electrical appliance housing of the kind initially referred to which avoids the disadvantages of the prior art and develops the latter further in advantageous manner. In particular an actuating button is to be connected to the membrane in such a way that water is prevented from penetrating through the housing wall.

This object is accomplished according to the invention by an electrical appliance housing in accordance with claim 1. Preferred embodiments of the invention are the subject-matter of the dependent claims.

According to the present invention the actuating button is fastened to a base of hard plastics material that is bonded to the material of the membrane. The hard plastic base is hermetically connected to the membrane such that no water can reach the interior of the housing, with the plastics materials of the base and the membrane being preferably related with each other in order to ensure a firm bond. The actuating button can be made of various materials without having to give consideration to a suitable material pairing of the membrane and the actuating button with a view to obtaining a tight connection to the membrane. The membrane can be injection-molded onto the hard plastic base in a two-component injection-molding process.

In a further aspect of the invention the base which supports the actuating button is connected by means of at least one elastic bar to the hard plastic housing body. Preferably, the elastic bar is constructed to exhibit material homogeneity with the housing body and/or the base and is formed in one integral piece therewith. In particular the base, the at least one bar and the housing body can be injection-molded in one integral piece from plastic, for example, polypropylene or ABS. The elastic bar, which connects the base to the housing body, not only makes it easier to position the base in the aperture in the housing body when the elastic membrane is molded on. The elastic bar also supports the membrane, which is an advantage in particular with extensive membranes which otherwise tend to form creases or be excessively yielding.

To obtain absolute watertightness of the housing in the region of the actuating button, the base on which the actuating button sits is constructed free of through-holes. The actuating button penetrates the base but not fully, with the result that there is no aperture extending all the way through from the outside of the base to the inside of the base.

The membrane may enclose the base not only on its circumferential surface but basically could cover, at least partly, also the end faces of the base as if the base were quasi cast integrally with the membrane. Preferably, however, at least the end face of the base facing the outer side of the housing is constructed free of any overlay by the membrane. On the end face of the base facing the outer side of the housing provision is made in the membrane for a recess which amounts more or less to the end face area of the base. According to a preferred aspect of the invention the base penetrates the membrane from its outer side to its inner side, i.e., the end face of the base facing the inner side of the housing is also constructed such that it is not overlaid by the membrane.

The at least one elastic bar previously mentioned, which connects the base to the housing body, could basically be cast integrally with the membrane. However, to obtain an

attractive appearance the at least one elastic bar does not lie on the outer side of the membrane. Preferably the bar lies on the inner side of the membrane. This is advantageous not only for visual reasons but also provides a support for the membrane when the latter is depressed with a finger-tip.

For its good visual and tactile recognition, the actuating button is constructed raised relative to the membrane.

According to an embodiment of the invention the actuating button and the base are preferably separate components and joined together, which enables them to be made of different materials. While the base is made preferably of the same material as the housing body, the actuating button can be made of metal, ceramic, glass or plastic.

The actuating button and the base can be joined together in various ways. According to a preferred embodiment of the invention the base has a blind-end bore receiving a shaft-shaped section of the actuating button. The shaft-shaped section can be press-fitted in, adhesively bonded to, or cast integrally with the blind-end bore. To prevent the actuating button or shaft from detaching itself from the blind-end bore, at least one radial rib and/or bead can be provided on the shaft. Such a radial projection digs into the wall of the blind-end bore in the base, thereby preventing the possibility of detachment.

To obtain a durable connection between the actuating button and the base, it is also possible for the actuating button to be welded to the base.

In an alternative further aspect of the invention the actuating button and the base can also be constructed to exhibit material homogeneity in one integral piece. In this case the base simultaneously forms the actuating button.

It is important, in particular when the actuating button is subsequently joined to the base and projects outwardly beyond the latter, for no dirt to be able to get in between the membrane and the actuating button. Therefore, provision is made in accordance with a preferred embodiment of the invention for the membrane to have an edge section that encloses the base and projects beyond the base towards the outer side of the appliance and which abuts with a precise fit or preferably with a press-fit against an edge section of the actuating button. When the actuating button is joined to the base, the edge section of the membrane is deformed such that a press fit is obtained between the actuating button and the membrane. In order for this pressure not to cause detachment of the membrane from the base, it is preferable for the base to have a radial projection on its end face facing the inside of the housing, preferably a circumferential shoulder for seating engagement with the membrane. When the actuating button is then

placed on the base from the outside, thereby causing the edge section of the membrane to be compressed, then the radial projection on the base absorbs the corresponding pressure exerted on the membrane. The membrane is compressed between the radial shoulder of the base and the radially projecting edge of the actuating button.

The edge section of the membrane, which projects to the outside of the housing prior to mounting the actuating button, can form an annular collar which with its end face engages the underside of the actuating button.

Alternatively, the edge section of the membrane around the base may also form a boundary for a recess that is coaxial with and adjacent to the base and into which the actuating button is inserted with a precise fit. For snug seating of the actuating button on the membrane also in this embodiment, the recess of the membrane as well as the underside of the actuating button can be shaped in a conical configuration, with the recess preferably having a smaller cone angle than the cooperating underside of the actuating button section.

In order to obtain an improved support of the membrane in cases where an extensive membrane is used, at least one protruding membrane support member in the form of a wing or a thin plate or the like can be fastened, preferably molded, onto the base and/or the at least one elastic bar. As the result, the membrane is supported not only by the area of the elastic bar itself but also by the additional area provided by such a protruding membrane support member. Irrespective of the mechanical effect, such a protruding plate or the corresponding wing can also be molded onto the base or the membrane in order to achieve a special visual effect.

The base can also be connected by means of plural elastic bars to the edge of the housing aperture. This also results in an improved support of the membrane.

Conveniently, the material of the membrane is bonded not only to the material of the base, which supports the actuating button, but also to the material of the housing body. The membrane is molded onto the edge of the corresponding housing aperture using the two-component injection-molding method.

Further objects, advantages, features and application possibilities of the present invention will become apparent from the subsequent description of preferred embodiments which are depicted in the Figures of the accompanying drawings. It will be appreciated that all the features described and/or depicted, whether individually or in any meaningful combination, constitute the subject-matter of the present invention, irrespective of their summarization in the claims or the back-references of the latter. In the drawings,

FIG. 1 is a sectional view of the housing body of an electrical appliance housing, taken along the line A-A of FIG. 2, showing a fragment of the housing body with an aperture and a base disposed therein for fastening an actuating button;

FIG. 2 is a top plan view of the housing body and the aperture of FIG. 1 provided therein;

FIG. 3 is a sectional view of the housing body similar to FIG. 1, showing the housing aperture sealed by means of an elastic membrane and an actuating button prior to its fastening to the base in the housing aperture;

FIG. 4 is a sectional view of the housing body similar to FIG. 3, showing the actuating button in condition as joined;

FIG. 5 is a sectional view, similar to FIGS. 1, 3 and 4, of an electrical appliance housing according to an alternative embodiment of the invention, showing the actuating button being joined to the base arranged in the membrane by means of a sonotrode;

FIG. 6 is a sectional view, similar to FIG. 3, of another preferred embodiment of an electrical appliance housing, showing a conical actuating button prior to being joined to the base arranged in the membrane;

FIG. 7 is a sectional view, similar to FIG. 4, of still another preferred embodiment of an electrical appliance housing;

FIG. 8 is sectional view, similar to FIG. 7, of yet another preferred embodiment of an electrical appliance housing;

FIG. 9 is a sectional view, similar to FIGS. 3 and 6, of an electrical appliance housing according to a further preferred embodiment of the invention, showing the actuating button prior to being joined to the base arranged in the membrane, joining to the base being performed by friction welding;

FIG. 10 is a sectional view of the electrical appliance housing of FIG. 9, showing the actuating button in condition as joined to the base;

FIG. 11 is a sectional view, similar to the preceding Figures, of another preferred embodiment of the invention, in which the actuating button is molded onto the base using the two-component injection-molding process;

FIG. 12 is a sectional view, similar to the preceding Figures, of an electrical appliance housing according to still another preferred embodiment of the invention, in which the actuating button is constructed to exhibit material homogeneity with the base;

FIG. 13 is a sectional view, similar to FIG. 1, of a housing body of an electrical appliance housing according to a preferred embodiment of the invention, showing two bases for accommodating two actuating buttons in one housing aperture, the section being taken along the line B-B of FIG. 14;

FIG. 14 is a top plan view of the housing body of FIG. 13;

FIG. 15 is a sectional view, similar to FIGS. 1 and 13, of a housing body of an electrical appliance housing, in which a base for accommodating an actuating button in a housing aperture is integrally formed on the housing body by means of two elastic bars, the section being taken along the line C-C of FIG. 16;

FIG. 16 is a top plan view of the housing body of FIG. 15;

FIG. 17 is a top plan view, similar to FIG. 16, of a housing body according to another embodiment of the invention, showing a plate-shaped membrane support member integrally formed on the base; and

FIG. 18 is a top plan view, similar to FIGS. 16 and 17, of a housing body according to still another embodiment of the invention, showing plural membrane support members in the form of wings integrally formed on base and bar in the housing aperture.

FIGS. 1 to 4 are fragmentary views of the housing 1 of an electric toothbrush or a similar electrical appliance comprising a housing body 2 made from a hard plastics material such as polypropylene or ABS and having in its wall 3 an aperture 4 which in the embodiment shown has an approximately rectangular circumference with radiused corners. It will be understood, of course, that the aperture 4 may also be shaped in other forms.

Extending from the edge of the aperture 4 into the aperture 4 is a thin bar 5 which is a part of the housing body 2. As FIG. 1 shows, the bar 5 is molded integrally with the wall 3. On its free end the bar 5 supports a base 6 which is aligned roughly central to the aperture 4 and in the embodiment shown has an approximately cylindrical contour. On its end facing the inner side 7 the base 6 has a radially projecting shoulder 8 (cf. FIG. 1).

The bar 5, which extends parallel to the plane of the aperture 4, lies approximately at the lower edge of the aperture 4 facing the inner side 7.

The housing body 2 including the bar 5 and the base 6, and the aperture 4 are manufactured by means of injection molding. In a second injection-molding operation a membrane 9 is injected into the aperture 4, molded over the bar 5 and around the base 6. As FIG. 3 shows, the membrane 9 has a low elevation 10 in the form of an annular collar extending circumferentially around the base 6. The membrane 9 is made of a soft plastic such as TPE. During the injection-molding operation this soft plastic material forms a bond with the hard plastic material of the wall 3 of the housing body 2 and of the bar 5 and base 6 which are molded onto the housing body. The plastic materials of the housing body 2 including the bar 5 and the base 6 and the material of the membrane 9 are related with each other, thus resulting in a firm bond. As FIG. 3 shows, the thickness of the membrane 9 is smaller than the thickness of the wall 3. The surface of the membrane 9 facing the outer side 11 lies lower than the level of the wall 3 of the housing body 2 surrounding the aperture 4. The housing body 2 thus has a slight depression in the region of the aperture 4 sealed by the membrane 9.

An actuating button 12 of roughly mushroom shape is fastened to the base 6. The actuating button 12 is comprised of a head 16 and a shaft-shaped neck 17 onto which a sharp-edged, radially projecting rib 18 is molded. The actuating button 12 can be made of metal such as steel, stainless steel, aluminum and the like or, alternatively, of a very hard plastic or ceramic or glass. The surface can be finished by means of electroplating, anodic oxidation, etching, coating, dyeing, grinding or blasting and the like. Instead of the one rib 18 it is also possible for plural ribs to be arranged axially in series on the shaft-shaped neck 17.

As FIGS. 3 and 4 show, the actuating button 12 is cold-pressed into a blind-end bore 19 constructed in the base 6, the rib 18 becoming anchored in the process in the wall of the blind-end bore 19. Placing the actuating button 12 down onto the base 6 compresses the elevation 10 of the membrane 9 between the shoulder 8 of the base 6 and the head 16 of the actuating button 12. The resulting press-fit prevents dirt getting in between the membrane 9 and the head 16 of the actuating button 12.

To make it easier to press the neck 17 into the blind-end bore 19, the actuating button 12 can be heated prior to being pressed in. If the actuating head 12 is made of metal, it can be heated by induction in a high-frequency electric field.

Alternatively, it is also possible for the actuating button 12 to be pressed into the blind-end bore 19 of the base 6 by means of a sonotrode in the form of a ram 20 vibrating at ultrasonic frequency, as is shown in FIG. 5. The ultrasonic vibration is introduced into the actuating button 12, causing the hard plastic of the base to be heated through friction at the contact surface with the actuating button 12. This makes it easier to for the neck 17 and the rib 18 to enter

the blind-end bore 19 and for the plastic to flow into the annular space between the head 16, the neck 17 and the rib 18. After cooling, the actuating button 12 is solidly connected to the base 6. As FIG. 5 shows, the membrane in this embodiment has no bar-shaped elevation around the base 6 but a recess 21 whose contour corresponds to the head 16 of the actuating button 12 and in which the head 16 sits with a precise fit after insertion of the button into the base 6.

In the embodiment of FIG. 5 both the head 16 of the actuating button 12 and the recess 21 in the membrane 9 have a cylindrical contour. Alternatively, as shown in FIG. 6, the recess 21 in the membrane 9, which adjoins the base 6 axially toward the outer side, can be conically constructed and increase in diameter toward the outer side 11 at an angle α. The head 16 of the actuating button 12 is shaped in a conical configuration. It decreases in diameter toward the neck 17 at an angle ß, which is preferably larger than the angle α of the recess 21. Furthermore, the largest diameter D_2 of the head 16 is somewhat larger than the corresponding diameter D_1 of the recess 21. After the actuating button 12 is pressed in, the soft plastic of the membrane 9 in the vicinity of the head 16 is under tension, thus preventing the ingress of dirt into the recess 21.

Alternatively to the previously described embodiments, the neck 17 of the actuating button 12 can also be constructed with a smooth finish, i.e., free of projections. As FIG. 7 shows, the neck 17 sits with a precise fit in the blind-end bore 19 of the base 6 and is bonded thereto by an adhesive. The recess 21 in the membrane matches the head 16 of the actuating button 12.

In a further variant of the actuating button 12 shown in FIG. 8, its neck 17 supports an annular bead 22 instead of the previously described sharp-edge rib 18. In this variant the actuating button 12 is cast integrally with the base 6. The actuating button 12 is inserted in the injection mold such that hard plastic is molded around the neck 17 and the bead 22 when the housing body 2 is injection-molded. In the second molding step the soft plastic membrane 9 is then molded on by the two-component injection method.

The actuating button 12 does not necessarily have a neck 17 adjoining the head 16. FIGS. 9 and 10 show an embodiment in which the actuating button 12 is comprised of only the head 16, with its underside constructed preferably flat. The base 6 is constructed somewhat raised in relation to the membrane 9, thus enabling the actuating button 12 to be joined to the base 6 by welding, for example friction welding. Here the base 6 and the actuating button 12 are preferably made from the same plastic or related plastics, with both parts able to have different colors. If the actuating button 12 is made of ABS, a decorative metal layer can be applied by electroplating to the visible faces prior to welding. As a comparison of FIGS. 9 and 10

shows, the base 6 is slightly abraded during friction welding to the actuating button 12, resulting in the underside of the actuating button 12 resting flush on the upper side of the membrane 9 after the joining operation.

As FIG. 11 shows, the actuating button 12 can also be fastened to the base 6 by the two-component injection-molding method. In this case the actuating button 12 is made of hard plastic, which preferably is at least related with the plastic of the base 6, in order to obtain a firm bond in the injection-molding operation. Through the separate molding-on of the actuating button 12 it can be given a different color than the housing body 2, thus achieving good recognition. The membrane 9 is molded on in a third injection-molding operation.

The embodiment of FIG. 12 shows an actuating button 12 which is formed by the base 6 itself. In this embodiment the actuating button 12 is produced as a continuation of the base 6 during the injection molding of the housing body 2. The membrane 9 is molded around the actuating button 12 in the second injection-molding operation. In this embodiment the housing body 2 and the actuating button 12 have the same color. However, recognition of the actuating button 12 can be very good when the membrane 9 has a different color. This version is characterized by being particularly cheap to manufacture.

As FIGS. 13 and 14 show, it is of course possible to arrange two bases 6 in the aperture 4 of the housing body 2, thus enabling two actuating buttons to be fitted. As the result, several function elements lying underneath the membrane can be actuated. It is also possible for a switch lying underneath to be switched on with the one actuating button and for the same switch to be switched off with the other actuating button. As FIGS. 13 and 14 show, the two bases 6 are each arranged on a separate bar 5, each of which extends from the wall 3 of the housing body 2 into the aperture 4. Independent actuation of the actuating buttons fastened to the two bases 6 is thus possible, regardless of the influence of the membrane 9.

According to another embodiment of the invention provision is made for the base 6 to be supported in the aperture 4 by two bars 5. As FIGS. 15 and 16 show, the two flat bars, which are arranged in a common plane parallel to the plane of the aperture 4, are shaped in an arcuate or undulating configuration in order to minimize the bending resistance in a direction transverse to their plane. They extend to opposite lying edges of the aperture 4. After a membrane is molded around the bars 5 and the base 6, the base 6 can receive an actuating button in the way previously described.

An extensive membrane 9 may be required in the housing body 2 in particular for aesthetic reasons. To fulfill this need, there is however a risk of the membrane 9 becoming deformed and forming bulges or creases for example. To remedy this, a membrane support

member 23 protruding parallel to the plane of the aperture 4 can be molded onto the bar 5 and/or the base 6. As FIG. 17 shows, a membrane support member 23 in the form of a thin plate can be fastened to the base 6 and the bar 5, the plate being arranged roughly concentric to the aperture 4. According to the embodiment of FIG. 18, it is also possible to provide plural membrane support members 23 in the form of fingers or wings which extend in the plane of the aperture 4 away from the base 6 and transverse from the bar 5. After a membrane of soft plastic is molded around the bars 5, the base 6 and the membrane support members 23, the base 6 can receive an actuating button in the manner previously described.

In the previously described embodiments the actuating button 12 including the head 16, the neck 17 and the rib 18 or bead 22 are constructed with a round cross section. However, it is also possible to provide a non-round cross section in order to anchor the actuating button 12 in the base 6 in a manner preventing relative rotation. In this arrangement a direction symbol such as an arrow can be provided on the actuating button 12 to indicate the pushing direction and/or the effect of actuating the actuating button 12.

In the previously described embodiments the wall 3 of the housing body 2 as well as the membrane 9 are of essentially flat construction. It will be understood, of course, that curved walls or membranes can also be provided as an alternative.